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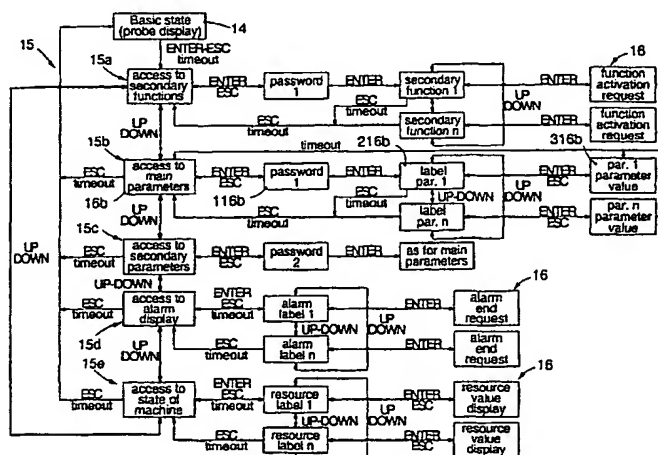
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(54) Title: **CONTROL DEVICE FOR REFRIGERATION, HEATING OR CONDITIONING PLANTS AND RELATIVE METHOD TO SET THE WORKING PARAMETERS**



(57) Abstract: Control device and relative method to set working parameters for refrigeration, heating or conditioning plants, said control device being equipped with means to interface (13) with the operator and including a setting pattern defined by a plurality of levels (15) each comprising one or more logical blocks (16), the method providing to run through all the levels, with their menus (15), and all the logical blocks (16) inside every level (15) acting on an extremely limited number of keys (13) individually without combining several keys and without needing to switch off the control device, said keys (13) having, for every menu and for every level (15)/logical block (16), a homogenous and substantially unified function, wherein said setting pattern has a single inlet (14) common to all said levels (15), the user starting from said inlet (14) being able to reach any level (15) or logical block (16) whatsoever by acting on said keys (13).

"CONTROL DEVICE FOR REFRIGERATION, HEATING OR CONDITIONING PLANTS AND RELATIVE METHOD TO SET THE WORKING PARAMETERS"

* * * * *

FIELD OF THE INVENTION

5 This invention concerns a control device for refrigeration, heating or conditioning plants, and also the relative method to set the working parameters, as set forth in the respective main claims.

The control device according to the invention is suitable
10 to be used as a regulator and/or measurer to control and govern temperature, pressure and/or humidity in a room, and particularly in the commercial or industrial field of refrigeration, heating or conditioning.

The control device according to the invention is
15 characterized in that it is easy and immediately intelligible for the user to use, and in that it guarantees the operator responsible for setting the parameters an extremely simplified operation, because there is a very limited number of keys, their functions are constant for
20 every level of setting and the operations to go through the relative menus are simplified.

BACKGROUND OF THE INVENTION

The state of the art includes electronic control devices equipped with a programmable unit, usually a microprocessor,
25 used to measure and govern parameters, for example the temperature and humidity, of a room, premises, a cooling unit, a heating plant or suchlike, defining an element of interface with the cooling unit which can be used both by the direct user and also by the operator responsible for
30 setting the parameters.

The electronic control devices are usually equipped with at least a display unit and a plurality of keys, used both to set the working parameters and also during the normal use

of the controller, which are functionally associated with the programmable unit.

Conventional setting methods of such controllers, used in the field of refrigeration, heating or conditioning, to allow to display/modify the configuration parameters, operational parameters, the state of the machine or otherwise, are generally complex, not very easy to understand or require the user to switch off the controller and switch it on again.

At present, in fact, the working of such controllers is based on a setting pattern which is organized on several levels of menu.

The state of the art includes, for example, setting patterns comprising a first level, with a main menu, accessible to any user, a second level, with a setting menu accessible only to authorized users and/or a third level, with a configuration menu accessible only to technicians or installation workers.

To access every level of the menu, for example to display or set particular parameters, the user has to follow specific procedures which comprise the simultaneous pressing of several keys, or has to switch the controller off, reset it and subsequently switch it on again.

Normally the operator has to switch off the controller and then, holding a pre-determined key pressed down, or in some cases, even more than one key simultaneously, he has to switch it on again to access the desired menu level.

In this setting method, therefore, a defined level of the setting pattern corresponds to every key or combination of keys.

In other words, the setting pattern of conventional controllers has a plurality of inlets, each corresponding to a level, and therefore, to pass from one level to another,

it is necessary to follow one of the procedures described above.

It is obvious that this setting method is not very practical or comprehensible, it is easily subject to mistakes, it requires the use of specialized personnel and/or a frequent consultation of the working instructions.

Moreover, every time the controller is switched off and on again, this is the possible cause of breakdowns and malfunctions of the controller or of the system controlled.

EP-A-332.957 discloses a command apparatus which can be used in association with a central heating plant; it has a command panel equipped with a very large number of keys, the function of which can be modified according to the variation in the level of functioning selected with which the apparatus is made to function.

For the setting and the display of the parameters, this document uses an LCD of the touch-screen type which is dynamic and easy to configure graphically, and is thus able to supply a plurality of functions and options which can be selectively activated.

Although on the one hand EP-A-332.957 solves some problems with regard to simplification and intelligibility, on the other hand it does so with a bulky and expensive solution; moreover, the user interface keys do not have a univocal function, which varies according to the setting level selected.

The present Applicant has devised and embodied this invention to overcome these problems and to obtain further advantages.

SUMMARY OF THE INVENTION

The invention is set forth and characterized in the respective main claims, while the dependent claims describe other innovative characteristics of the invention.

The purpose of the invention is to provide a control device which can be applied to refrigeration, heating or conditioning plants, whose functioning parameters are able to be set in a simple and easily comprehensible manner so that it can be used even by non-specialized personnel.

Another purpose of the invention is to provide a setting method which does not require diversified procedures, such as, for example, switching off the control device and then switching it on again, or pressing several keys at the same time, in order to pass from one menu to another of the setting pattern.

A further purpose of the invention is to provide a method achieved by a setting pattern structured in a very simple manner and wherein the method to access the various levels and relative menus, and also the method to display/modify the parameters, are substantially the same for every level and relative menu.

The invention allows to improve the interactive capacity of the control device by making it less laborious for the user to learn the said methods.

Moreover, it also allows quick and easy reconfiguring operations to personalize the functions of the control device according to the client's specific requirements.

The control device according to the invention is equipped with an interface unit comprising at least a display unit and access means for the user, consisting of keys or other elements functioning as keys, functionally associated with at least a programmable unit, for example a microprocessor.

According to the invention, the control device is equipped with an extremely limited number of multi-function keys, which gives extreme simplicity of use and a reduction in bulk, without entailing a reduction in the functioning capacity of the control device.

Moreover, the functioning capacity of the keys is always the same, whichever level of the setting menu we are on.

According to the main characteristic of the invention, the setting method proposed allows to set the control device by
5 acting simply on the keys and keeping the control device always switched on.

In accordance with this characteristic, the setting method according to the invention is achieved by a setting pattern comprising a plurality of levels, with their menus, all
10 having a single inlet in common.

According to a variant, when it is first switched on, the control device according to the invention, or rather the starting point of its setting pattern, automatically positions itself in correspondence with this single inlet.

15 Every level, with its menu, may include one or more logical blocks which allow to condition the functioning of the microprocessor and thus of the control device.

The logical blocks may include, for example, principal lists, parameter lists, lists of functions, value displays,
20 function activation or otherwise.

According to the invention the logical blocks are autonomous with respect to each other and may be combined together in various ways during the design stage of the control device, according to the specific use to which it
25 will be put and according to the client's specific requirements.

According to a variant, logical blocks are also provided, located in defined points of one level of the setting pattern, which require the operator to insert an access
30 code, or password, to be able to access the subsequent logical blocks.

This is particularly useful in the event that access to defined levels, with their menu, is to be reserved

exclusively for authorized personnel.

With the method according to the invention, in order to access each single level and to pass from one logical block to the other inside the same level of the setting pattern, it is enough to use one, appropriately chosen, of the multi-function keys of the interface unit.

The methods of access, moreover, are based on the same basic logical principle so that the user, having learnt the basic logical principle, is able to navigate along the whole setting pattern in a purely intuitive manner and without needing to have to continuously consult the specific instructions contained in the handbook.

According to a variant, the same key can fulfil more than one function, although homogenous and unified, depending on the type of level, or menu, or logical block in which it is used.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other characteristics of the invention will become clear from the following description of a preferred form of embodiment, given as a non-restrictive example, with reference to the attached drawings wherein:

Fig. 1 is a schematic front view of a control device according to the invention;

Fig. 2 shows the setting pattern of the control device in Fig. 1.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

With reference to Fig. 1, a control device 10 according to the invention is suitable to be used in the field of refrigeration, heating or conditioning to measure and govern defined parameters, for example the temperature and humidity of a room, a refrigeration unit, a heating plant or suchlike.

The control device 10 comprises a front panel 11 equipped

with a display unit, in this case a display 12, and four keys 13.

The display 12 and the keys 13 are functionally associated with a microprocessor mounted on an electronic card enclosed
5 within the containing structure of the control device 10 and therefore not visible in Fig. 1.

The four keys 13 comprise, in this case, an increase or "UP" key, 13a, a decrease or "DOWN" key, 13b, a confirmation or "ENTER" key, 13c, and a cancel or "ESC" key 13d.

10 The setting method of the control device 10 according to the invention is achieved by a setting pattern, shown in Fig. 2, with a single inlet 14 common to a plurality of levels, with their menus, 15.

When the control device 10 is first switched on, it is
15 automatically positioned in correspondence with the inlet 14, waiting to receive commands from the operator by means of the keys 13.

In this case, as a default function, in correspondence with the inlet 14 and when the device 10 is switched on, the
20 microprocessor is suitable to automatically show on the display 12 the value detected by a temperature probe, which is not shown here, connected at inlet to the control device 10.

It is obvious that the default function may be any other,
25 and may also be chosen according to the specific use made of the control device.

Every level, with its menu, 15 comprises at least a logical block to which a defined set of instructions for the microprocessor corresponds.

30 In practical terms, in correspondence with every logical block 16, the microprocessor is suitable to display on the display 12 a numerical value or writing, or a combination of numbers and letters, and to receive from the operator

specific instructions given by means of the keys 13, to memorize any parameters inserted/varied, and to command defined loads connected at outlet from the control device.

To navigate inside the setting pattern, that is, to move
5 from one level 15 to another or to move from one logical block 16 to another, the operator simply has to use the keys 13.

Every key 13 is suitable to perform more than one function correlated to the type of logical block 16 in which it is
10 used; all these functions, for every key 13, are in any case homogenous and easily intelligible in their meaning, since they always correspond, substantially, to that function which is implicitly connected in the basic function of the key 13.

15 In this case, for example, when the user is in the step of positioning on the various levels, the UP key 13a is used to pass from one level 15 to the subsequent one, or to increase the value of a parameter when he has passed inside a specific logical block 16 belonging to one of the levels 15.

20 Therefore, the key 13a always has substantially the same function of making an increase.

Similarly, the DOWN key 13b is used to pass from one level 15 of the setting pattern to the previous one, when the user is in the step of positioning on the various levels, or to
25 decrease the value of a parameter inside a specific logical block 16.

The ENTER key 13c is used, inside the same level 15, to pass from one logical block 16 to the following one, or, inside a specific logical block 16, to activate/de-activate
30 a particular function.

The ESC key 13d is used, inside the same level 15, to pass from one logical block 16 to the previous one or, inside a logical block 16, to abandon a specific function without

modifying the parameters.

In this case, the setting pattern shown in Fig. 2 comprises five levels, with their menus, identified by the numbers 15a to 15e, each comprising respective logical blocks 16.

In the case shown here, the five levels 15a-15e correspond respectively to: access to secondary functions, access to main parameters, access to secondary parameters, access to alarm display and access to the state of the machine.

As shown in Fig. 2 with a darker segment, the operator can move sequentially from one level 15 to the adjacent one by pressing the DOWN key 13b, if he wants to proceed from up to down along the setting pattern, or by pressing the UP key 13a to proceed from down to up, or to access a menu or function directly.

In fact, there may be functions which, starting from the inlet 14, allow to reach defined menus or functions directly.

When the operator has reached the desired level, with its menu, 15, he can navigate forwards between the various logical blocks 16 which make up said level from left to right by pressing the ENTER key 13c, or he can go back from right to left by pressing the ESC key 13d.

On the contrary, using the UP key 13a and the DOWN key 13b inside a specific logical block 16 increases/decreases the value of the specific parameter required by the microprocessor in correspondence with the logical block 16.

To give an example, we shall now refer to the condition wherein, starting from the inlet 14 of the setting pattern, in correspondence with which the control device 10 functions normally and the microprocessor is suitable to show on the display 12 a desired default value (for example the value measured by a temperature probe), the operator has reached

level 15b by pressing first the ENTER key 13c to reach level 15a and subsequently the UP key 13a to pass from level 15a to 15b.

According to a variant, which is not shown here, starting
5 from the inlet 14 of the setting pattern, the operator can reach level 15b by pressing twice in succession on the UP key 13a.

When the first logical block 16b of level 15b has been reached, the microprocessor of the control device 10 is
10 suitable to show some letters/figures on the display 12, for example Pr1.

In this way the operator understands that he has reached level 15b which allows him to set, or vary, the main working parameters of the control device 10.

15 In this case, the main parameters consist of a plurality of temperature thresholds of between 1 and n, indicated in the setting pattern respectively as included between a "label par. 1" and a "label par. n" in respective logical blocks 16.

20 By pressing the ENTER key 13c, it is possible to pass from the first logical block 16b to a second logical block 116b.

By pressing the ESC key 13d, on the contrary, from the first logical block 16b it is possible to return in correspondence with the inlet 14, skipping all the logical
25 blocks 16 between the latter and the logical block 16b.

Having reached the logical block 116b, the microprocessor of the control device 10 asks the operator to key in, using the keys 13, a pre-defined access code, or password.

By inserting the access code, it is possible to reach a
30 third logical block 216b, in correspondence with which the microprocessor is suitable to show some letters/figures on the display 12; in this case, our example shows "label par. 1".

In this way the operator understands that he has reached the logical block 216b which allows him to set, or vary, a first parameter, in this case a temperature threshold.

At this point, by pressing the ENTER key 13c, it is possible to reach a fourth logical block 316b in correspondence with which the microprocessor is suitable to show on the display 12 the value given to the parameter "par. 1".

Using the UP key 13a and the DOWN key 13b, the operator can vary the value of the parameter "par. 1" displayed at that moment on the display 12 until the desired value is reached and then he can confirm it, that is, memorize it in an integrated memorization unit, by pressing the ENTER key 13c.

This key 13c not only commands the memorization of the new value taken by the parameter "par. 1", but also allows to return automatically to the third logical block 216b.

From here, the operator can choose whether to continue to set/vary the other parameters between "par1" and "par n.", in the same way as used for parameter "par. 1", or to return to the first logical block 16b by pressing the ESC key 13d.

In this case, moreover, the setting pattern of the control device 10 also comprises an automatic function, indicated by time-out.

When a pre-determined and pre-settable period of time has elapsed without the microprocessor having detected the activation of one of the keys 13, this function automatically activates the passage from the logical block 16 active at that moment to another pre-determined logical block 16, skipping any other intermediate logical blocks 16.

To navigate along the other setting levels 15a, 15c, 15d the rules are exactly the same as we have seen above, as are the functions of the respective keys 13a-13d.

For example, level 15a regarding access to the secondary functions allows, by inserting a password, to access the desired secondary function and to activate it if it is not already activated, or to de-activate it if it is active.

- 5 Level 15c regarding access to the secondary parameters follows the same criteria seen above with reference to the main parameters.

Level 15d to display the alarms allows to select a desired alarm and to de-activate or, respectively, to activate it.

- 10 Finally, level 15e regarding access to the state of the machine allows to select a desired resource and to display the value thereof on the display 12.

- From Fig. 2 it is clear how all the passes of running through the menus and/or the levels, to modify the values, to activate a function, and every other operation of setting or use are extremely simplified, immediate and perfectly comprehensible.

- It is obvious that modifications and additions may be made to this invention, but these shall remain within the field and scope thereof.

CLAIMS

- 1 - Setting method for a control device for refrigeration, heating or conditioning plants, suitable to be used as a regulator and/or measurer to control and govern defined parameters, such as temperature, pressure and/or humidity in a room, said control device being equipped with means, or keys, (13) to interface with the operator and including a setting pattern defined by a plurality of levels, with their menus, (15) each comprising one or more logical blocks (16), the method being characterized in that it provides to run through all the levels, with their menus, (15) and all the logical blocks (16) inside every level (15) by acting on an extremely limited number of keys (13) individually without combining several keys and without needing to switch off the control device, said keys (13) having, for every menu and for every level (15)/logical block (16), a homogenous and substantially unified function, and in that said setting pattern has a single inlet (14) common to all said levels, with their menus, (15), the user starting from said inlet (14) being able to reach any level, with its menu, (15) or logical block (16) whatsoever by acting on said keys (13).
- 2 - Setting method as in Claim 1, characterized in that said logical blocks (16) comprise at least main lists, parameter lists, function lists, value displays, function activation, request for access code (password), or other.
- 3 - Setting method as in Claim 2, characterized in that said logical blocks (16) are substantially autonomous with respect to each other and suitable to be combined in various combinations with each other during the design or configuration step of the control device (10) according to the specific use to be made thereof.
- 4 - Setting method as in Claim 1, characterized in that access to the various levels (15) and logical blocks (16) is

achieved by using the same basic procedure common to all levels, with their menus, (15) which constitute the setting pattern.

5 - Setting method as in Claim 1, characterized in that it
5 provides to use two keys (13a, 13b) to run through all the levels with menus (15) in sequence, and to use the same keys (13a, 13b) to increase/decrease the value of a parameter inside a logical block (16).

6 - Setting method as in Claim 1, characterized in that it
10 provides to use a key (13c) to pass from one logical block (16) to the subsequent one inside the same level (15), and to use the same key (13c) to activate/de-activate a function relative to a logical block (16).

7 - Setting method as in Claim 1, characterized in that it
15 provides to use a key (13d) to pass from one logical block (16) to the previous one or to abandon a function, inside a logical block (16), without modifying the parameters.

8 - Setting method as in Claim 1, characterized in that it
20 provides to pass automatically from one logical block (16) to another, predetermined logical block (16), or to abandon a function inside a logical block (16), without modifying the parameters contained therein, when the interface means (13) are not used for a defined and pre-settable interval of time.

25 9 - Control device for refrigeration, heating or conditioning plants, suitable to be used as a regulator and/or measurer to control and govern defined parameters, such as temperature, pressure and/or humidity in a room, said control device comprising at least a programmable unit,
30 for example a microprocessor, to which means to interface with the operator, such as a display (12) and keys (13), are functionally associated, said programmable unit including a setting pattern defined by a plurality of levels with menus

(15), each comprising one or more logical blocks (16), a defined set of instructions for said programmable unit corresponding to each logical block (16), the device being characterized in that said programmable unit is suitable to
5 allow the working parameters of the control device (10) to be set, keeping said device (10) always switched on, and in that said setting pattern has a single inlet (14) common to all said levels, with their menus, (15), and in that said keys (13) are suitable to carry out different functions
10 according to the position in the setting pattern.

10 - Control device as in Claim 9, characterized in that there are four of said keys (13).

11 - Control device as in Claim 10, characterized in that, during the step of positioning at the various levels (15), a
15 first key ("UP"), or increase key, (13a) allows to pass from one level (15) of the setting pattern to the subsequent one and, inside a specific logical block (16), to increase the value of the parameter associated with said logical block (16).

20 12 - Control device as in Claim 10, characterized in that, during the step of positioning at the various levels, a second key ("DOWN"), or decrease key, (13b) allows to pass from one level (15) of the setting pattern to the previous one and, inside a specific logical block (16), to decrease
25 the value of the parameter associated with said logical block (16).

13 - Control device as in Claim 10, characterized in that, inside the same level (15), a third key ("ENTER"), or confirmation key (13c) allows to pass from one logical block
30 (16) to the subsequent one and, inside a specific logical block (16), to activate/de-activate a particular function associated with said logical block (16).

14 - Control device as in Claim 10, characterized in that,

inside the same level (15) a fourth key ("ESC"), or
cancellation key (13d) allows to pass from one logical block
(16) to the previous one and, inside a logical block (16),
to abandon a particular function associated with said
5 logical block (16), without modifying the parameters.

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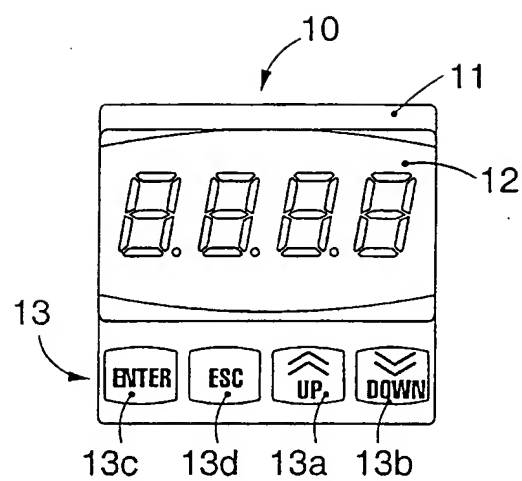


fig.1

2/2

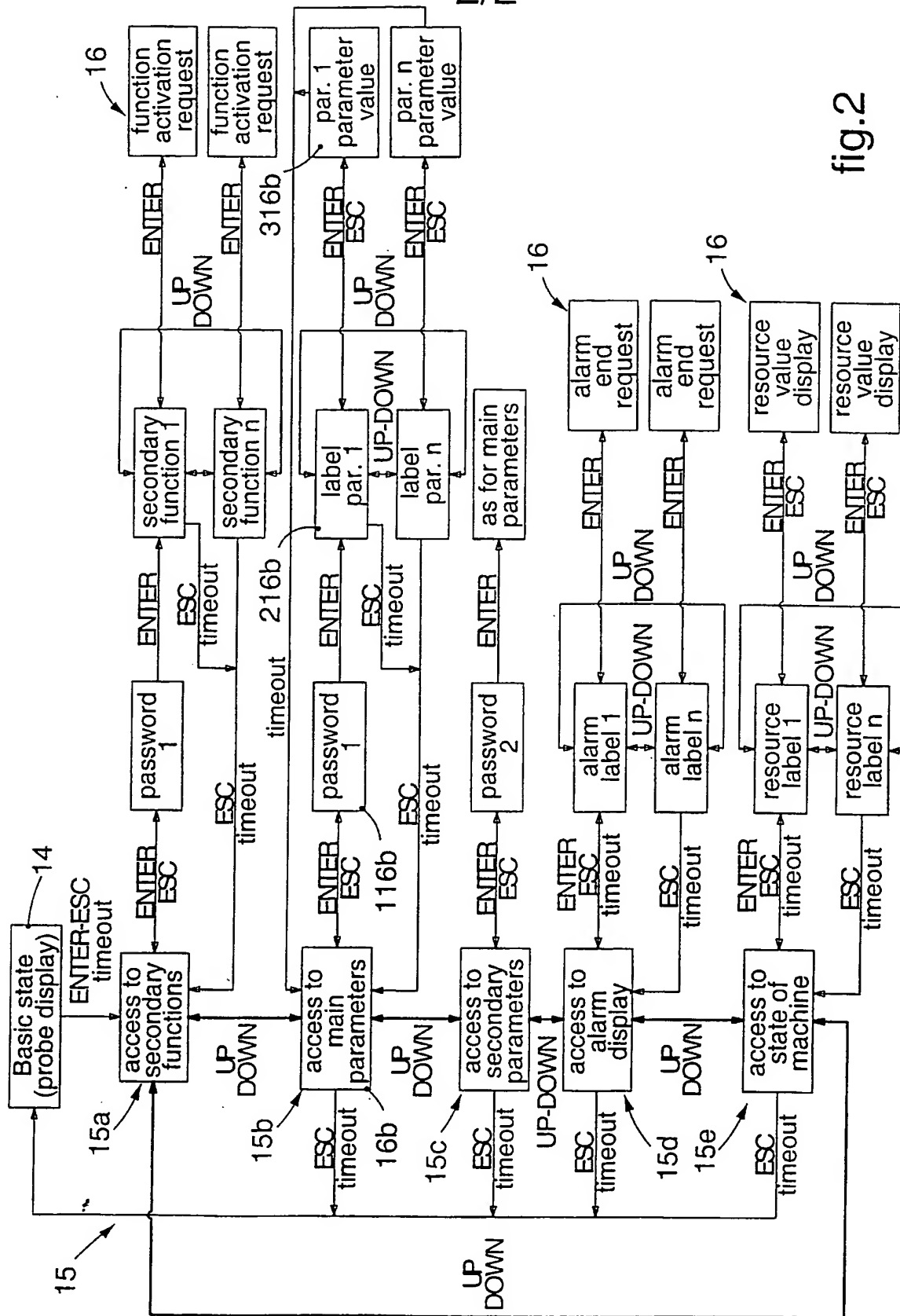


fig. 2

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 00/00738

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G05D23/19

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G05D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 332 957 A (TEM AG) 20 September 1989 (1989-09-20) cited in the application abstract column 3, line 55 -column 7, line 35; figures 1-10	1-4, 8, 9
A	EP 0 591 628 A (LANDIS & GYR BUSINESS SUPPORT AG) 13 April 1994 (1994-04-13) column 3, line 55 -column 5, line 5; figures 1-4	1, 9
A	US 5 398 597 A (JONES ET AL.) 21 March 1995 (1995-03-21) abstract column 15, line 43 -column 16, line 62; figures 4-7	1, 9
	-/-	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 00/00738

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 98 37364 A (DUSHANE ET AL.) 27 August 1998 (1998-08-27) page 11, line 36 -page 17, line 22; figures 1,4-8	1,9
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INTERNATIONAL SEARCH REPORT

information on patent family members

Inter: nal Application No

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